NOTES ON TWO CROSSES BETWEEN DIFFERENT RACES OF PIGEONS.

T. H. MORGAN.

The present note is intended to record the results of a few crosses with pigeons. Through a series of accidents the experiment came to an untimely end. The breeding carried to the second generation has given too few individuals to warrant any generalizations, but enough to suggest the desirability of more extended work along the same line. As it will take two years to carry the crosses again to the second generation it seems worth while to record the facts so far obtained.

Cross Between a White Fantail and "Swallow."

A pure white female fantail (Fig. 1) was paired to a male

Fig. 1.

swallow (Fig. 2). One of the chief features of the breed of fantails is the large number of tail feathers; in the bird used here 32 feathers were present. I wished to find out how this

character would behave when brought into connection with the normal number (12) of tail feathers possessed by the "swallow."

FIG. 2.

The First Generation.—Seven young were reared from this cross. The tails of these hybrids had respectively 17, 12, 13, 15, 14, 13, 13 feathers. The result shows an intermediate condition be-

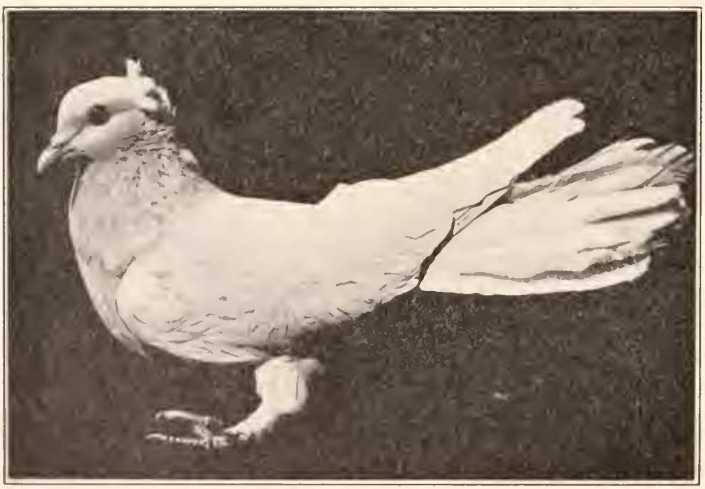

FIG. 3.

tween the parent types, with a distinct approach to the normal. The tail of the hybrid was not carried in the erect position as-

sumed by the fantail nor was it flat as in the other type, but formed a broad rather flat wedge like that of the fantail at rest, but not as high. It is shown in Fig. 3.

The F_2 Generation.—Only four birds were reared in this generation. Each had only twelve feathers in its tail. It may appear either that there is a further loss of tail feathers in this generation or that the normal number, twelve, represents the dominant type, and that the number of individuals is too small for the recessive type to reappear. Larger numbers must be obtained to settle this point, for, it seems not improbable that F_2 birds with more feathers than twelve are expected, even although the original number 32 may seldom or never reappear.

Other Characters.—It is not the object of this note to examine in detail the inheritance of other characters of these two breeds, but the following points may be mentioned. The fantail has a plain head (Fig. 1.), *i. e.*, no crest; the swallow has a crest. The F_1 birds all possess a crest. Some of the F_2 birds have a crest, others lack it. One bird that was killed is not recorded for crest.

The swallow has feathers on the tarsus and toes (Fig. 2), the fantail lacks these (Fig. 1). The F_1 birds have feathers on tarsus and toes, but less developed than are those of the father. Two of the F_2 birds lack feathers on the tarsus and toes, one bird resembles the F_1 hybrid, and one has well feathered tarsus and toes. In the last case the feathers are as long, and as well developed, as in the swallow.

The fantail was pure white, the swallow has a dark top to the head, dark wings, and the feathers of the feet are light bluish. The wings are grayish blue and brown with two brown bars (Fig. 2). The tail, back, neck and ventral surface are white. The F_1 birds are pure white. Two of these birds showed two or three slate-colored feathers near the outer edge of the wings, generally to be seen only by brushing back the white feathers or when the wing is extended. Two of the F_2 birds are pure white, two were splotched, one with red, and one with brown. Only a small number of these colored feathers were present, but they were scattered unequally over the body and showed no tendency to be grouped on the wings and head alone.

[1] Owing to injury by rats the head was too much eaten to give certain records for the crest.

Summary.—The F_2 generation was intermediate in number of tail feathers, feathers on legs, and color, although in regard to the last point the birds were practically like the white parent, a few feathers alone placing them in the intermediate class. The crest was dominant. The F_2 generation showed segregation practically complete for the feathers on the legs, it showed segregation of white color to some extent, the recessive type appearing only to a very limited degree. The number of tail feathers showed a return to the normal, but the number of individuals is too small to lay much emphasis on the point. Yet it is significant that in all other directions the F_2 birds sufficed to show the influence of both parents.

Cross Between a Turbit and a Starling.

The F_1 hybrids of those birds were given to me by Mr. E. B. Southwick, who kept both parent stocks. The turbits (Fig. 4) were not very high-bred strains, but showed the main characteristics of their class. Their color is red or blue. The head is uniformly colored and has a crest; the wing bars are dark; along the middle line of the breast there is a series of reversed feathers (Fig. 4). The starling (Fig. 5) was a black bird with a white top to the head and white wing bars. On the breast there is a large light crescent with a metallic tinge. There are no reversed feathers on the breast.

The two hybrids (F_1) were red birds (Fig. 6). The crest was well developed. The top of the head was white (like that of the starling), but in one case not so sharply delimited. The wing bars were dark.

From these two hybrids eight, F_2 birds were reared. Five have crest and two lack the crest, five are red and three blue, all but one have darker bars on wing. That one has a dark bar on most of the feathers of the wings but a few feathers have white bars.

Summary.—The most interesting result of this combination is the failure of the reversed feathers on the breast to reappear in the second generation. The result is like that of the number of tail feathers in the fantail-swallow cross, but here also the numbers are too small to make any conclusions possible, however

significant the absence of reversed feathers may appear. The *white* top of the head and the creast appear to be dominant; while the *white* wing bars are recessive.

FIG. 4

CONCLUSIONS.

As stated above the number of individuals reared is too small to warrant any extensive generalizations, but it is apparent that while certain characters show evidence of mono-hybrid inheritance, three characters do not furnish as good evidence. These three characters are the number of tail feathers in the fantail, the color pattern of the swallow, and the reversed breast-feathers of the turbit. It is probable that each of these characters has not been formed by a single step, but by a series of steps.[1] If this be granted it follows that the conditions present in the two races respectively can not be represented by a pair of Mendelian characters. There are then two interpretations; first, if the characters Mendelize there must be more than two factors involved; second the characters in question may come under some other kind of inheritance in which simple Mendelian segregation does not occur, or possibly the results may be partly Mendelian, partly not. A large number of F_2 offspring will be necessary before these points can be settled, but enough has been found, I think, to show at least in cases like these when a type

[1] See Morgan, T. H., "Experimental Zoölogy," page 171, New York, 1907.

has been formed either under domestication, or in Nature, not by one mutational step alone, but by a series of successive steps

FIG. 5.

along the same line, that the crossing with the original type or with a related type does not give Mendelian inheritance for one

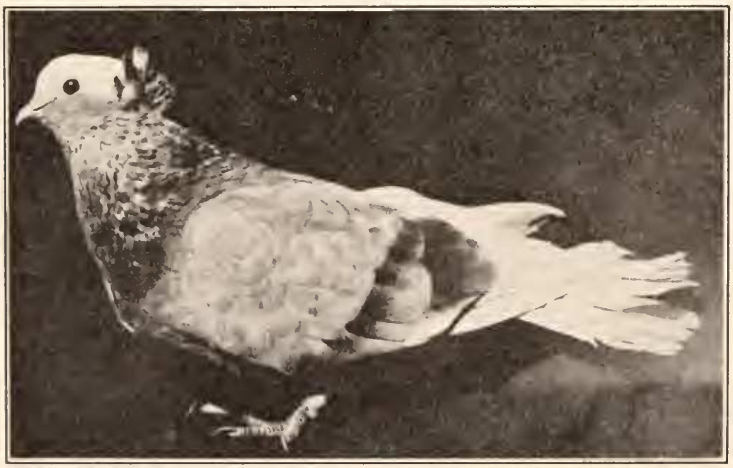

FIG. 6.

pair of characters. What we should expect under such circumstances we do not know as yet for we are now dealing with a

series of progressive or orthogenetic variations and not with a retrogressive mutation.

There is another result that seems to me to be especially significant. The white on the top of the head of the starling is dominant to the plain (colored) head of the turbit, but the white wing bars of the starling are recessive to the dark wing bars of the turbit. Unless these are two different kinds of white, one dominant (inhibitor of color) and the other recessive (absence of color) the result is difficult to explain, unless as I have suggested [1] the segregation in mosaic types is not germinal but ontogenetic.

[1] "The Influence of Heredity and of Environment in Determining the Coat Colors in Mice," *Annals New York Acad. Science*, XXI., July, 1911.